

The Bialowieza specimen had a two-layered skull, in other words, pneumatization was fully completed: this occurs in House Sparrows at about 181–240 days. According to data given by Nero (1951) one could suppose the specimen to be of this age. However, prolonged boiling of the skull with sodium bicarbonate during its preparation revealed that the hybrid may be even older. By measurements, the hybrid skull is fairly similar to young, unossified skulls of House Sparrow, but since pneumatization was complete it could not be treated as a young bird. Moreover, it was shown that skull proportions change with age *i.e.* they are correlated with degree of pneumatization (Ruprecht, in prep.). For example, index 6 : 5 decreases with age in *P. domesticus*, and its value for hybrid specimens is similar to 6 weeks old House Sparrows.

The occurrence of hybrids in the wild is very interesting and surely not a common phenomenon, in spite of the fact that, according to Meise (1951), differences in the behaviour and appearance of different sparrow species do not hinder their hybridisation.

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Measurements of some *Streptopelia* doves and their hybrids

by S. J. J. F. DAVIES

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INTRODUCTION

During studies of the behaviour of *Streptopelia* doves and their hybrids at the Sub-department of Animal Behaviour, Cambridge, the bill length, body weight and egg length of a range of species and their hybrids were measured. The species used were *S. roseogrisea*=*risoria* (Barbary Dove), *S. decaocto* (Collared Dove), *S. turtur* (Turtle Dove), *S. chinensis* (Necklace Dove) and *S. senegalensis* (Senegal Dove). Cole and Hollander (1950) have published data on the body weights of hybrid *Columba livia* x *Streptopelia risoria* which showed the hybrids to be intermediate between the two parents. Irwin and his co-workers (*e.g.* Underkofler and Irwin 1965) have made extensive studies of the inheritance of blood antigens in *Streptopelia* doves, although the differences they studied have been qualitative rather

than quantitative. They have been particularly concerned with antigens specific to the hybrids which, they think, may be of general importance in the interpretation of heterosis. The material available at Madingley was extensive, both in number and type and enables the patterns of inheritance shown by these characters to be discussed, even though no detailed genetic analysis is possible.

A considerable proportion of this material has been deposited in the Bird Room at the British Museum (Natural History) where it will be available for future studies.

METHODS

All the doves were kept in outdoor cages in the grounds of the Sub-department of Animal Behaviour at Madingley, Cambridge. A few of the delicate hybrids were kept in small indoor cages during winter, but the doves were otherwise confined to 6 ft. x 6 ft. x 6 ft. wire-netting aviaries or in larger flights 18 ft. x 6 ft. x 8 ft. They were fed on a mixture of wheat, millet and cracked maize, and allowed free access to water and green food. Many of them bred under these conditions and the stock remained healthy throughout the work.

The bill measurements were all made by the author with a pair of vernier callipers, from the tip of the bill along its chord to the limit of the feathering on the top of the upper mandible. Most measurements were made within a period of a fortnight in the early spring of 1963, but a few were made subsequently until May 1964.

The body weights were measured on a table balance over the period 13–18 February, 1964, between 0900 hrs. and 1700 hrs. The doves were restrained in a box during weighing. No special precautions were taken to ensure that the bird's alimentary canal was empty when weighed, but it is thought that the diurnal variation in the food contained in the alimentary canal would not be great compared with the weight of the birds themselves.

Eggs whenever they were available between April 1963 and May 1964, were measured with vernier callipers by the author.

The "t" test was used to examine the significance of the differences between means unless otherwise stated.

(a) *Bill length*

RESULTS

Table 1 gives the mean bill length in centimetres of each species and hybrids kept at Madingley. The standard errors of the means are also given.

In the Necklace x Barbary Dove hybrid the mean bill length is almost identical with that of the Necklace, and significantly greater than that of the Barbary parent ($P < 0.05$). In the Turtle x Barbary hybrid the mean bill length of the F_1 is intermediate between that of the two parent species and significantly different from both ($P < 0.05$). In the Barbary x Collared hybrid* the mean bill length is greater ($P < 0.05$) than that of the Barbary parent, and greater, but not significantly so, than that of the Collared. There was no sexual dimorphism in bill length in the Barbary and Collared doves, nor in their hybrid, but it did occur in the Necklace ($P < 0.05$). The differences between the sexes of the Necklace x Barbary and the Senegal x Barbary were not significant in either case, and the data for the other dove types were inadequate for the possibility of sexual dimorphism to be tested.

* Both Barbary x Collared and Collared x Barbary crosses are included, since there was no evidence of a difference between them.

TABLE 1

The mean bill lengths in centimetres of the doves kept at Madingley. Standard errors of the means are also given:

<i>Species</i>	<i>Sex</i>	<i>Mean Bill Length</i>	<i>Number Measured</i>	<i>S.E. of Mean</i>
Barbary	Both	1.66	46	0.012
Collared	"	1.70	11	0.024
Turtle	"	1.90	6	0.028
Necklace	Male	1.84	3	0.015
	Female	1.74	5	0.051
Senegal	Both	1.64	5	0.078
<i>Hybrids</i>				
C x B	Both	1.74	12	0.021
T x B	"	1.74	11	0.028
N x B	Male	1.82	9	0.042
	Female	1.77	5	0.163
S x B	Male	1.66	6	0.028
	Female	1.60	4	0.016
N x C	Both	1.74	6	0.017

(b) *Body weight*

Body weight showed sexual dimorphism, and in some species and hybrids the males weighed more than females. Table 2 gives the mean body weight in grams of each sex for the doves, together with the standard errors of the means. Not all the species showed sexual dimorphism, but comparisons have been restricted to birds of the same sex. The mean body weight of Necklace x Barbary males is significantly ($P < 0.05$) greater than that of Necklace males and greater than that of Barbary males but not significantly so. The Senegal x Barbary hybrid, on the other hand, is intermediate in body weight between its two parent species, and significantly different ($P < 0.05$) from both.

TABLE 2

The mean body weights in grams for both male and female doves kept at Madingley; the standard errors of the means are also given:

<i>Species</i>	MALE			FEMALE		
	<i>Mean Body Weight</i>	<i>Number of Birds</i>	<i>S.E.</i>	<i>Mean Body Weight</i>	<i>Number of Birds</i>	<i>S.E.</i>
Barbary	164.2	17	4.3	165.7	15	4.1
Collared	171.6	11	5.5	176.5	6	7.6
Turtle	Both sexes: Mean 160.1			No. 7 S.E.		
Necklace	125.7	10	5.4	102.8	7	5.3
Senegal	103.4	5	7.3	104.4	4	6.0
<i>Hybrids</i>						
C x B	166.9	9	3.1	154.4	3	2.6
T x B	163.7	6	8.9	159.5	4	6.4
N x B	174.0	9	8.0	171.6	6	8.7
S x B	133.5	6	2.9	139.9	5	7.7
<i>Second generation birds</i>						
F ₂ (C x B)	156.7	6	1.4	154.5	3	5.3
(C x B) x B	167.5	4	1.0	145.0	1	—
(C x B) x C	154.3	3	3.1	157.5	1	—
(N x B) x B	162.4	4	4.5	144.0	1	—

(c) *Egg length*

Table 3 gives the mean egg measurements for individuals of the species and hybrids for which data are available. In some cases in which two or more females were laying in the same cage it was not possible to identify the eggs of the individuals and the measurements have been grouped together. An analysis of variance of egg length, given at the bottom of Table 3, shows that the variation within birds and within breeds is about the same and much less than that between breeds. For this reason the data from these groups of hens have been used as if the data came from a single hen.

In order to examine the data presented in Table 3, so that the significance of the differences between species and hybrids might be tested, a non-parametric statistical test, the Mann-Whitney U test (Siegel 1956) was used. The means of one dove type were ranked with the means of the type with which comparison was being made. The values of U calculated from these rankings gave a measure of significance for each comparison. The values of U are not given, in the interests of space. Of the pertinent comparisons only the Necklace x Barbary egg length is significantly different from that of each of its parent species, and intermediate between the two ($P < 0.05$).

TABLE 3

The mean egg length in centimetres of individual doves, or groups of doves in some cases, representing the types kept at Madingley. The standard error of the mean is given in each case:

<i>Species</i>	<i>Individual</i>	<i>Mean Length</i>	<i>No. of Eggs</i>	<i>S.E. of Mean</i>
Barbary	Group	3.01	39	0.019
	a	3.06	5	0.021
	b	2.90	5	0.041
	c	3.01	2	0.050
Collared	a	2.82	4	0.011
	b	2.81	8	0.029
	c	2.92	1	—
Necklace	Group	2.74	5	0.086
	a	2.48	5	0.023
	b	2.64	9	0.051
	c	2.58	3	0.062
Senegal	a	2.46	4	0.025
	b	2.58	8	0.017
<i>Hybrid</i>				
C x B	a	2.87	2	0.039
T x B	Group	2.97	6	0.042
	a	2.94	14	0.023
N x B	b	2.90	10	0.032
	Group	2.78	19	0.036
	a	2.82	9	0.053
	b	2.87	8	0.037
	c	2.88	4	0.042
	d	2.87	4	0.036
S x B	e	2.90	4	0.032
	Group	2.78	9	0.023
N x C	a	2.69	6	0.040
	Group	2.96	16	0.025
	a	2.98	2	0.038
	b	2.82	2	0.007

Analysis of Variance of Egg Length

	Degrees of Freedom	Mean Square	Variance Ratio	P
Between breeds	8	0.5181	20.40	<0.01
Between birds within breeds	19	0.0254	2.07	<0.05
Within birds	185	0.0123		

The mean egg lengths of the Necklace x Collared hybrid, are significantly ($P < 0.05$) larger than those of the Necklace parent and the means indicate that they tend to be larger than those of the Collared parent as well, but there are too few means to make a realistic test of the difference.

(d) Relative variability of hybrids and pure species

The variation shown by the hybrid material is of the same order as that shown by the pure species. Table 4 gives the coefficient of variation for the three measurements from all types of doves on which measurements were made. Inspection shows that the hybrids appear to be neither more nor less variable than the pure species, with the exception, perhaps, of the Necklace x Collared bill length, and the characters of the Collared x Barbary hybrids, especially body weight and egg length. Falconer (1960) gives a number of examples in which the F_1 generation is less variable than the parent species, but it is to be remembered that all his examples refer to crosses between lines within species, whereas all the dove hybrids discussed above are inter-specific crosses. It is interesting, therefore, to find that the Collared x Barbary cross is the one in which the F_1 's tend to be less variable than the pure species, since current opinion (references in Vaurie 1961) suggest that these two birds, although specifically distinct, are more closely related to each other than are any other pair of species studied here. The reduced variability of the F_1 Collared x Necklace cannot be accounted for in this way, but it may be connected with the fact that all the Collared x Necklace hybrids were derived from one mating, whereas each of the other crosses was made several times with different birds.

TABLE 4

The coefficients of variation calculated from the morphological data given in Tables 1, 2 and 3. In the case of egg measurements the data from the group or if there is no group from the individual from which most measurements were obtained has been used.

Species	Bill length	Body Weight		Egg length
		Male	Female	
Barbary	4.84	10.69	9.58	3.99
Collared	4.76	10.64	10.52	2.92
Turtle	3.63	Both	9.03	—
Necklace	6.33	13.56	13.51	6.93
Senegal	9.76	15.85	11.48	1.82
C x B	4.08	5.65	2.88	1.88
T x B	5.34	13.26	8.03	3.43
N x B	3.87	13.84	12.42	5.68
S x B	4.69	5.39	12.26	2.45
N x C	0.75	—	—	3.34
<i>Second Generation Birds</i>				
F_2 (C x B)	—	6.73	5.98	—
(C x B) x B	—	12.01	—	—
(C x B) x C	—	3.49	—	—
(N x B) x B	—	5.54	—	—

(e) *General*

Without many more breeding experiments no further genetic analysis can be made of these results. The patterns of inheritance shown in the morphological characters of the doves are well known in the inheritance of characters in other organisms. There is no correlation between the pattern of inheritance shown by one character in a particular cross and that shown by another. For example, the Necklace x Barbary hybrid follows the Necklace parent in bill length, but approaches the Barbary parent in body weight; it is intermediate in egg length.

In three cases the mean measure for the F_1 hybrid is above that of both parental species (Barbary x Collared—bill length; Necklace x Barbary—body weight; Necklace x Collared—egg length (possibly)), although in each case the difference is significant between the hybrid and one parent only. Exaggeration of a character in a hybrid beyond the range of both parents is a well known phenomenon and these results do no more than suggest that it occurs in the morphological characters of *Streptopelia* doves studied here.

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New information on the Solomon Islands Crowned Pigeon, *Microgoura meeki* Rothschild.

by SHANE PARKER

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Perhaps the finest ornithological discovery of the naturalist and collector Albert S. Meek (1871-1943) was the striking ground pigeon *Microgoura meeki*; Meek himself held this view.

This aberrant species is still only known from seven skins (five in the American Museum of Natural History, one in the British Museum [Natural History], one untraced) and an egg (in the B.M. [N.H.]), obtained by Meek and his collectors during January 1904 on the island of Choiseul. I intend discussing the location of Meek's three camps on Choiseul in a later paper dealing with his three expeditions to the Solomon Islands; here I am concerned mainly with the information obtained about this pigeon